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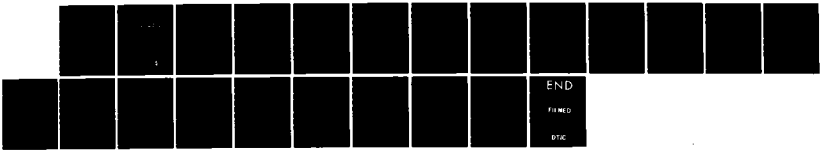

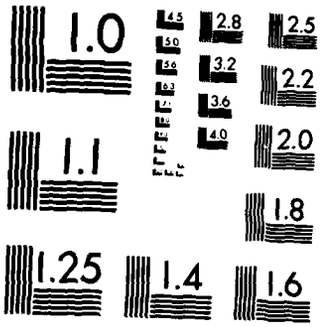

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Review of the 1973 Airport and Airway Cost Allocation Study

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ABSTRACT

This document reviews DOT's 1973 Airport and Airway Cost Allocation Study [Reference 1]. Specific attention is given to formulation of the cost base, evaluation of alternative cost allocation methods, and calibration/application problems. User comments regarding the 1973 study are also classified and briefly reviewed, and their relevancy to the current study discussed. Finally, potential areas of improvement are summarized.

SUMMARY

A review of the 1973 Airport and Airway Cost Allocation Study is considered a necessary first step in projecting airport and airway costs for 1977-1986 and allocating these costs to the various user groups. There is general concurrence by the reviewers with the cost allocation method selected (long run marginal cost) by the 1973 Cost Allocation Study. However, some specific problems emerged from the review. The extent of public interest costs was restricted to safety regulation, national capital airports, and operations of Government-owned aircraft. There are other areas of FAA operations that have costs incurred in public interest that were not accounted for (e.g., service to small communities, military requirements). There were statistical problems in estimating the cost allocation equations, and there is a need to establish a better causal relationship in allocating R&D, F&E and support costs. Furthermore, the method of allocating residual costs of a long-run marginal cost allocation scheme in proportion to marginal costs can be improved upon through consideration of users' price elasticities of demand for ATC services.

Users' comments generated by the 1973 Cost Allocation Study were also reviewed. Only previously documented comments (formal or informal) were considered, and no direct attempt was made by MITRE METREK to solicit comments from user groups. The majority of the users' comments dealt with the cost recovery phase and an opposition to the concept of full cost recovery through increased taxation. Two suggested improvements to the cost allocation phase were repeatedly cited. The first dealt with public interest costs as discussed earlier. The second area of major concern from the general aviation community related to assigning cost responsibilities to users only to the extent of their requirements for the ATC services and not for any "extra" services that might have been imposed upon them by the need for a joint system.

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1. INTRODUCTION

The U. S. Department of Transportation (DOT) published a study on Airport and Airway Cost Allocation in 1973 [Reference 1]. As a first step in projecting and allocating future FAA costs to system users, the previous DOT study (referred to hereafter as the 1973 Cost Allocation Study) was reviewed. To further aid the current efforts, a review of users' comments on the 1973 Cost Allocation Study was also conducted to identify areas of concern to the aviation community. The following sections present a review of the 1973 study, a review of the users' comments, and potential areas of improvement.

2. REVIEW OF 1973 AIRPORT AND AIRWAY COST ALLOCATION STUDY

2.1 Background and Synopsis of Findings

The 1973 Airport and Airway Cost Allocation Study was conducted in response to a Congressional mandate expressed in the Airport and Airway Development and Revenue Act of 1970. The purpose of this study was to: 1) determine the costs of Federal airport and airway support, 2) determine an appropriate method of allocating costs among users and the public and then to calculate the costs, and 3) recommend equitable means of cost recovery responsibilities of each party. This study, initiated in 1970, was quite extensive in nature.

The cost base used in the 1973 study covered the period 1966 through 1975. This achieved a balance, at the time, between historical and budgeted future costs. The cost base included FAA costs as well as the costs incurred by several other Federal agencies in connection with the airport and airway system.

Airport and airway costs were separated into five functional categories: airport systems, terminal control systems, en route control systems, flight service systems, and support systems. These areas were further divided into four cost categories: research and development (R&D), facilities and equipment (F&E), relocation and modification (R&M), and operations and maintenance (O&M).

Three cost formats were developed for presenting the cost data base. These formats differed in the way that they treated capital costs. Model calibration and application was conducted with all three cost formats. The recommended cost format was Format II which uses base period annual costs with amortized current and future capital costs. Except for deduction of the costs of safety regulation and operations of government-owned aircraft, no credit was provided in these cost bases for costs incurred in the public interest or for any form of subsidy. In the allocation phase, all costs were converted to constant dollars.

Three user groups were considered in the analysis: general aviation (GA), air carrier, and military. This review examines the process of assigning cost shares to each of the three groups. Recovery of these allocated costs from individual users is another related area of investigation, but is not examined in this report.

Ten cost allocation methods were examined for their suitability in assigning airport and airway costs. Economic and practical evaluations were provided for each. The criteria used in selecting

2.2 Critique of Selection and Application of Cost Allocation Techniques

The following sections deal with evaluations performed and decisions made in the 1973 cost allocation study with respect to cost base, alternative cost allocation methods, and calibration and application procedures. Actions taken in these topic areas are briefly summarized and critiqued. Generally, the reviewers limited their comments to noting exceptions; when in agreement with assessments made in the 1973 study, comments were not usually made.

2.2.1 Cost Base

Three alternative formats spanning a large range were considered. The selection process reached a result that, although not incontrovertible, was supported by logical argument. Cost format III, which used annual costs with amortized capital costs for present, past, and future years, was the preferred alternative. However, format II, which is similar to format III except for not amortizing past costs, was finally selected due to data problems with format III.

Two comments are appropriate to this section. First, it would have been useful to present results that differentiated costs by agency (e.g., FAA, Department of State). Secondly, failure to deduct costs incurred in directly serving public needs (e.g., military requirements, small community service) had the effect of penalizing users by overstating their cost responsibilities.

2.2.2 Evaluation of Alternative Cost Allocation Methods

Ten cost allocation methods were examined. These consisted of: benefits/value of service, units of use, measures of use (1) & (2), long-run marginal cost, long-run incremental cost, separate facilities cost, separable cost/remaining benefits, long-run cost responsibility, and peak/off-peak costs. In general, the discussion was clear and was based on sound economic reasoning. However, there seemed to be widespread confusion in the differences between joint and common costs. Following is a brief summary of each of the ten methods that were evaluated.

The benefits/value of service method assigns clearly-allocable costs first and then allocates the remaining costs in a multi-step process in proportion to the benefits and value of service received by users. A number of practical deficiencies are associated with determination and calculation of user benefits and value of service. In addition, this method suffered from a lack of causal relationship to cost incurrence.

specific needs of each group, and then allocating total costs in proportion to these separate facilities costs. This method ignores the considerable uncertainty of how separate facilities systems would be configured, and it also ignores the economies of scale that are present in the existing system. However, it points out that the costs of a separate facilities system, if properly defined, serve as an appropriate bound on cost recovery for user groups.

The separable costs/remaining benefits method allocates basic costs, as does the long-run incremental cost method, by assigning avoidable costs to each user group. The remaining costs are allocated in proportion to the remaining benefits of each group. Remaining benefits are calculated by subtracting avoidable costs from the minimum of benefits or separate facilities costs. Although the quantitative differences between this method and the preferred method (LRMC) are small, separable costs/remaining benefits was not selected because it does not fulfill criteria of economic efficiency as satisfactorily as does LRMC.

The method of long-run cost responsibility differs from other cost allocation techniques by avoiding measures of user activity or benefits. In this method, aircraft are grouped homogeneously with respect to technical requirements imposed on the airport and airway system. Incremental costs are assigned to each aircraft class according to its responsibility for existence of airport and airway system components. Joint costs are distributed equally at each stage among all users. This method is somewhat arbitrary, insufficient data exists to derive good results, and the method appears to be inappropriate when used for non-airport components.

In the peak/off-peak cost method, costs are allocated as a function of the peak usage of each group. This method was rejected because no useful results were obtained. Perhaps there are not significant variations among groups, but rather than classifying peak/off-peak as a separate method, peak/off-peak should be considered as a potential disaggregating factor for other methods, and not outrightly rejected.

2.2.3 Calibration and Application Problems

Some specific problems were detected in the calibration and application of the cost allocation methods. Data problems and other limitations were partially responsible for this circumstance. Following is a description of these problems.

technology. The existence of heteroscedasticity is likely to bias statistical tests, which could lead to incorrect conclusions.

Perhaps the most important statistical problem was the presence of insignificant t-statistics in the calibrated cost functions.* Nearly fifty of the equations that were used were left with insignificant t-statistics (See Appendix A). Of these, four appeared in the list of equations that were finally used to calculate long-run marginal costs. This compares with a total of approximately eleven equations that were used in these calculations. While the use of equations containing statistically insignificant coefficients will not necessarily bias the results, this problem is notable because some of the equations in question affected key areas.

When cost functions included insignificant t-statistics, the offending coefficient was usually, although not always, set equal to zero. While not necessarily harmful, this practice is liable to bias estimates of the models' coefficients. A better practice would have been to recalibrate the models using another functional form or at least excluding the insignificant term. Another possible course that might have been successful in eliminating insignificant t-statistics is to employ finer disaggregation among types of users and types of uses.

* t-statistics, as usually used, indicate the statistical likelihood that an econometrically-estimated coefficient is significantly different from zero.

3. REVIEW OF USERS' COMMENTS

Due to the nature of the study (with its possible impact on cost recovery through user charges), the 1973 Cost Allocation Study has attracted comments and criticisms (rational and emotional) over the full spectrum of cost base, cost allocation, and cost recovery. This section presents a review of the documented comments (formal, informal, congressional letters, etc.) that were available. No direct attempt was made by MITRE METREK to solicit comments from user groups. Documented comments from the air carrier community were sparse. Information concerning the general aviation community was obtained from past comments made by NBAA, AOPA, GAMA, and the FAA Office of General Aviation [References 8-11], as well as from letters to the U. S. Congress. The following three subsections summarize the main objections and criticisms of the 1973 Cost Allocation Study voiced by various individuals and organizations of the aviation community. *Each subsection also discusses the relevancy of the comments to the current effort.*

3.1 Users' Comments on the Cost Base

The majority of the comments on the cost base were concerned with the inclusion of specific cost items in the analysis and the treatment of the cost base. Users suggested that the following costs be excluded from a cost allocation study:

1. Non-FAA Costs, (OST, NASA, NOAA, Department of State, etc.) as not being a part of the airport and airway system cost.

2. FAA R&D and O&M costs on the grounds that R&D should either be left to the private sector or not be a cost recoverable item, and O&M costs as not being a part of the Trust Fund which is for capital improvements only.

3. Sunk costs, which have been paid through the Trust Funds in the past and which should not be included in a cost allocation study.

Comments on the treatment of the cost base consisted of:

1. A more detailed analysis of "Support Function" of FAA is required. The 1973 study identifies about 30% of the cost as support costs.

2. Actual Federal expenditures and not approved budget costs should be used.

6. The operations counts of air carrier are understated, and those for general aviation are overstated.

7. Linear cost allocation formulas are not appropriate under the assumption of diminishing costs per additional operation.

8. The regression analysis based on the past performance may overstate costs because the past includes some error and inefficiencies of the early stages of a developing ATC system.

9. All FSS costs are not oriented toward general aviation requirements.

In the current effort, FAA costs incurred in public interest have been addressed in some detail and are presented in Reference 5. Such identified costs have been allocated to the public sector. To provide an assessment of the general aviation requirements, a lower bound for general aviation allocation has been estimated based on a hypothesized minimum services GA-only system in Volume V of this series [Reference 7]. The effect of peak/off-peak use was explored further as presented in Volume III of this series [Reference 5]. An attempt to subdivide general aviation into more homogeneous classes was not successful due to lack of data. The implications of the heterogeneous nature of general aviation and required measures in a cost recovery phase are briefly discussed in the report dealing with a hypothesized GA-only system. The impact of Government-owned and operated planes, as well as charter, ferry, maintenance and training flights of airlines are removed from the general aviation category as was done in the final version of the 1973 Cost Allocation Study. The details of the cost allocation process, together with the theoretical implications, are presented in Volume IV of this series [Reference 6].

3.3 Users' Comments of Cost Recovery

A major concern of the users with the cost allocation study was its implications for cost recovery. The following items summarize the major users' comments in this category:

1. There should be no attempt to recover all airport and airways costs from the users. Federal subsidy should continue for aviation just as it does for railroads, buses, etc.

2. There should be no tax increase on the aviation users and the historical "equity" of taxes should be maintained.

4. POTENTIAL AREAS OF IMPROVEMENT

There are several areas of possible improvement for a revised cost allocation study other than the obvious step of updating the data base to reflect new information. These areas of possible improvement are: consideration of additional cost allocation methods, greater reflection of public benefits when determining cost allocations, and enhancement of causal relationships between cost responsibilities and costs imposed on the system.

The first area of potential improvemement involves the cost allocation methods considered. Although the 1973 study examined ten alternatives, other possibilities exist. Some of these other possibilities are simply minor variants of the ten methods considered. However, several important alternative methods were omitted. These methods are: price discrimination, average benefits, and a modified version of long-run marginal costs.

Price discrimination and average benefits are alternative forms of value-of-service allocation methods. The most important of these omitted methods is a modification of LRMC that allocates residual costs by applying a surcharge that varies as an inverse function of the price elasticities of demand of users. This modified LRMC method has strong theoretical support and, for use in airport/airway cost allocation, is superior to the basic LRMC method that was employed in the 1973 Cost Allocation Study [Reference 6].

The second area of possible improvement deals with subsidy. The 1973 Cost Allocation Study found no justification for Federal subsidy other than regulatory functions. However, economic theory seems to justify public subsidy to the airport and airway system because of the existence of external benefits that apparently cannot be captured without subsidy. Yet, it is doubtful that as much subsidy should be granted as some GA and other users claim is warranted. At the very least, it appears that the costs incurred in serving the public interest should be deducted from the costs that should be recovered from users. This step is necessary for fair and consistent treatment of all parties.

Finally, improvements are possible in establishing more causal relationships between cost responsibilities and the costs that users impose on the airport and airway system. Four points are particularly important. First, engineering models should be substituted for econometric models when simple functional forms are not sufficient to characterize complicated cost functions, when a valid causal relationship does not exist, when adequate historical data is lacking (such as for future system designs),

APPENDIX A

STATISTICAL AND OTHER RELATED COST ALLOCATION PROBLEMS

This appendix addresses specific problems of the 1973 Cost Allocation Study (as summarized in Reference 1) in a detailed fashion. Section 1 is a wide-ranging discussion of statistical and other cost allocation problems. Section 2 addresses insignificant t-statistics in particular.

1. STATISTICAL AND OTHER COST ALLOCATION PROBLEMS

1.1 Long-Run Marginal Cost (LRMC) Estimation

As an initial observation, there appears to be a technical error present in all but one of the tables of regression results in Chapter 7. (The exception is Table 7-7, p. 102, where there is another error of a different type, to be discussed subsequently). The persistent error relates to the calculation of one of the "evaluation statistics," i.e., the coefficient of determination, adjusted for degrees of freedom, $\bar{R}^2$. The conventional formula for calculating the adjusted statistic is:

$$\bar{R}^2 = 1 - \frac{n-1}{n-k}(1-R^2)$$

ref.: J. Johnson, Econometric Methods, McGraw-Hill, 1972, p. 130

or its algebraic equivalent:

$$\bar{R}^2 = R^2 - \frac{k-1}{n-k}(1-R^2)$$

ref.: J. Kmenta, Elements of Econometrics, McMillian, 1971, p. 365

where n and k are the sample size and number of parameters, respectively. Taking as an example the first equation (T-F&E-1) in the first table (7-1, p. 89), the $\bar{R}^2$ value corresponding to the reported R^2 of .863 should be:

$$\bar{R}^2 = .863 - \frac{(4-1)(1-.863)}{(252-4)} = .861$$

The value given in the table is .626. At a minimum, this problem has a disturbing effect on the reader of the study, and may have led to incorrect choices from among alternative cost-estimating equations.

of uncertainty attached to the estimate of that parameter, the $1.38 value was retained and treated as "the" GA long-run marginal cost for en route O&M cost allocation. Everything being considered, that was not an unreasonable position since, on a priori grounds, $1.38 seems more reasonable than zero, and since there was no alternative data base nor estimation procedure immediately available to the study.

In retrospect, however, it appears that the $1.38 was not a good estimate of General Aviation's O&M marginal cost. Specifically, it appears to have been low, both in absolute and relative terms. With reference to the alternative explanation given above, the assertion here is that the available data did not provide an adequate basis for estimating the GA parameter. That the GA estimate is low is supported by three pieces of evidence. First, in Working Paper No. 5, Measures of Use, en route O&M unit costs were postulated to be inversely proportional to the average speeds of the different user group aircraft. General Aviation's average speed being lower than that of either Air Carrier or Military, the cost of a GA IFR aircraft handled was therefore judged to be higher than the other user groups, not seventy or eighty percent lower as the regression results suggest.

A second bit of evidence was obtained with the en route cost function was re-estimated (using the original cost allocation study data) by the method of Ridge Analysis, or Ridge Regression. A technical exposition of that method appears as Appendix A to An Econometric Analysis of En Route and Terminal Air Traffic Control, Report No. FAA-AVP-77-1, June 1976. For the present purposes, it is sufficient to describe the method as an iterative procedure designed to combat the effects of multicollineariety (high intercorrelation among independent variables), with the first iteration being the conventional least-squares estimates. The ridge results indicated that the GA cost coefficient was underestimated and the AC coefficient overestimated. The fundamental problem appears to have been collinearity between the AC and GA activity variables.

A final source of evidence was obtained when the function was re-estimated using more current (1974) cost and activity data. Those results were:

AC	GA	MIL
13.83	9.96	17.60
(6.00)	(2.56)	(5.27)

lead to the so-called problem of specification bias--the effects of omitted variables being picked up in the coefficients of the included ones. Again, one can only speculate about the seriousness of this problem, but it would definitely seem to qualify as a problem.

1.2 Cost Allocation Procedures

The preceding section reveals that the 1973 Cost Allocation Study estimates of en route and terminal O&M marginal costs were subjected to close scrutiny in the present study. There were three reasons for this. First, together those two categories account for more than half of the General Fund expenditures. Second, a more recent data base was available for validating/refining the original estimates. Finally, because of the inherent nature of these costs, there are few if any sound alternatives to empirically-estimated LRMC as an allocation basis. The same is not true, however, for some of the other cost categories, which is the subject of this section.

Of concern here is the allocation of R&D, F&E, Support and Grants-in-Aid (identified by the 1973 Cost Allocation Study as Paving and Land) costs. Consider first F&E and Paving and Land, where LRMC were developed as a basis for allocation. The problem with that approach is that the cost measures hypothesized to be determined by aviation activity levels are in actuality measures of capital stock. Those stocks have accumulated over a period of years in amounts that bear little direct, or logical, connection to any single year's mix of AC, GA or MIL activity. Moreover, even if such a connection did exist, there is no basis for postulating that the relationship would extend into the future. In the case of F&E, each new year's costs reflect decisions to implement specific programs related to system safety, productivity and capacity increases. An analogous situation exists with respect to Grants-in-Aid, where there are legislatively determined parameters applicable to Air Carrier and General Aviation facility enhancement. Thus, rather than rely on a set of marginal costs estimated from what is essentially a cumulative time series of sunk costs, it would seem more reasonable--first in the case of F&E--to perform an engineering analysis of the nature and objectives to those outlays, and to effect the allocation accordingly. For the Grants program, since the target groups and dollar amounts are spelled out in the enabling legislation, a strong case can be made that the allocation problem has resolved itself.

With regard to the allocation of R&D costs, the preceding study, rather than attempting to develop LRMC per se, adopted an allocation rule whereby those costs (after being distributed to Airport

of approximately eleven equations (possibly more, depending on how classified) that were used in these calculations [Reference 1, pg. 109]. Under some conditions cost equations with statistically insignificantly coefficients might be accepted for cost allocation purposes. This occurs when the resulting calculations are relatively insensitive to the coefficients in question or when the functional form and coefficient values otherwise seem reasonable. This condition was not always met in the 1973 study.

When cost functions included insignificant t-statistics, the offending coefficient was often, although not always, set equal to zero. While not necessarily harmful, this practice is liable to bias estimates of the models' coefficients. A better practice would have been to recalibrate the models using another functional form or at least excluding the insignificant term. Another possible course that might have been successful in eliminating insignificant t-statistics is to employ finer disaggregation among types of users and types of uses. Retaining the estimated values of statistically insignificant coefficients is not usually a good situation.

TABLE A-1

INSIGNIFICANT T-STATISTICS FOUND IN 1973 COST-ALLOCATION MODELS
(Concluded)

REGRESSION #	INSIGNIFICANT COEFFICIENTS**
ER-O&M-11	Intercept, log(GA Aircraft)
ER-O-1	Intercept, GA Aircraft
ER-M-1	GA Aircraft
ER-M-2	Log(GA Aircraft)
8 Navaid Models	Too numerous to list
FSS-O&M-1	$(FS)^2$
FSS-O&M-4	$(FS)^2$
T-O-F&E-A	GA Operations, $(AC\ ops)^2$, $(GA\ ops)^2$
T-O-F&E-B	GA operations, Military operations
T-O-O&M-A	GA Operations, Military Operations, $(AC\ ops)^2$, $(GA\ ops)^2$, $(Mil\ ops)^2$
T-O-O&M-B	GA Operations, Military Operations
T-O-O&M-C	Intercet, Operations, $Operations^2$
T-I-F&E-A	$(Military\ Instrument\ Operations)^2$
T-I-O&M-A	$(AC\ Instrument\ Ops)^2$, $(Mil\ Instrument\ Ops)^2$
T-I-O&M-B	GA Instrument Operations
T-I-O&M-C	Instrument Operations, $(Instrument\ Operations)^2$
T-A-F&E-A	GA Instrument Approach, $(AC\ Instrument\ Approach)^2$, $(GA\ Instrument\ Approach)^2$
T-A-F&E-B	Military Instrument Approach
T-A-O&M-A	Military Instrument Approach, $(Mil\ ins\ app)^2$
T-A-O&M-B	GA ins app, Mil ins app
T-A-O&M-C	$(Instrument\ Approach)^2$, Ins app F&E

* Used in final cost calculations

** @ 95% confidence level

APPENDIX B

GLOSSARY

A.C./ AC	AIR CARRIER
A-P/ AP/ ARPT	AIRPORT
AAT	FAA AIR TRAFFIC SERVICE
ADAP	AIRPORT DEVELOPMENT AID PROGRAM
ADM/ ADMIN	ADMINISTRATION
ADV	ADVISORY
AFTN	AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK
AOPA	AIRCRAFT OWNERS AND PILOTS ASSOCIATION
ARSR	AIR ROUTE SURVEILLANCE RADAR
ARTCC	AIR ROUTE TRAFFIC CONTROL CENTER
ARTS	AUTOMATED RADAR TRAFFIC CONTROL SYSTEM
ASC	ADMINISTRATIVE SCIENCES CORPORATION
ASR	AIRPORT SURVEILLANCE RADAR
ATC	AIR TRAFFIC CONTROL
AVP	FAA OFFICE OF AVIATION POLICY
C-AP	CAPITOL AIRPORTS
CAB	CIVIL AERONAUTICS BOARD (SEE ALSO TRACAB)
CAP	CAPITOL
CENT	CENTRALIZED
CONUS	CONTINENTAL UNITED STATES
CSC	COMPUTER SCIENCES CORPORATION
CTR	CENTER (EN ROUTE)
DCA	WASHINGTON NATIONAL AIRPORT
DCS	DATA COMMUNICATIONS SYSTEM
DEV	DEVELOPMENT
DIR	DIRECTION
DME	DISTANCE MEASURING EQUIPMENT
DOD	DEPARTMENT OF DEFENSE
DOT	DEPARTMENT OF TRANSPORTATION
E&D	ENGINEERING AND DEVELOPMENT
F ST/ FLT STDS	FLIGHT STANDARDS
F&E	FACILITIES AND EQUIPMENT
F,E&D	FACILITIES, ENGINEERING AND DEVELOPMENT
FAA	FEDERAL AVIATION ADMINISTRATION
FAC	FACILITY
FREQ	FREQUENCY
FSS	FLIGHT SERVICE STATIONS
FY	FISCAL YEAR
G.A./ GA	GENERAL AVIATION
GAMA	GENERAL AVIATION MANUFACTURERS ASSOCIATION

S&S	STAFF AND SUPPORT
SRMC	SHORT RUN MARGINAL COSTS
SUP	SUPPORT
TACAN	TACTICAL AIR NAVIGATION AID
TCS	TECHNICAL CONTROL SERVICE
TR	TRAFFIC
TRACAB	TERMINAL RADAR CONTROL FACILITY COLOCATED WITH A CONTROL TOWER
TRACON	TERMINAL RADAR CONTROL FACILITY
TRN	TRAINING
TWEB	TRANSCRIBED WEATHER BROADCASTS
TWR	TOWER (TERMINAL)
U.S.	UNITED STATES
UG3RD	UPGRADED THIRD GENERATION
UHF	ULTRA HIGH FREQUENCY
UNICOM	AERONAUTICAL ADVISORY STATION
VCS	VOICE COMMUNICATIONS SYSTEM
VFR	VISUAL FLIGHT RULES
VHF	VERY HIGH FREQUENCY
VOR	VHF OMNI-RANGE (NAVIGATION AID)
VORTAC	COLOCATED VOR AND TACAN

APPENDIX C

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APPENDIX D

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